

RP 813 Wind Turbine Generator Bearing Grease Sampling Procedures

The following recommended practice (RP) is subject to the disclaimer at the front of this manual. It is important that users read the disclaimer before considering adoption of any portion of this recommended practice.

This recommended practice was prepared by a committee of the AWEA Operations and Maintenance (O&M) Committee.

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Purpose and Scope

The scope of “Wind Turbine Generator Bearing Grease Sampling Procedures” discusses the methods for taking uncontaminated and trend-able grease samples from wind generator bearings. Samples that are taken properly can provide the user with accurate data for maintenance decision making.

The general procedure applies to wind turbine lubrication systems. There are several different manufacturers of generators and each may have a slightly different configuration which could require slight modifications of this procedure. This paper will address one of the more commonly seen configurations in a wind turbine generator: a bearing bottom exit hole and a mating chute to direct purged grease to a catch tray. Following methods laid out in ASTM D7718, “*Standard Practice for Obtaining In-Service Samples of Lubricating Grease*”, these recommendations will give proper procedures for dealing with the chute, gathering grease samples, and the use of sampling devices to ensure that data obtained from grease analysis is accurate.

Introduction

Performing grease analysis from a specific sampling location is important in ensuring repeatability and accuracy. Unlike oil samples, which can more thoroughly mix and circulate through a gearbox or other location, greases are semi-solids and their flow behavior is quite different. Known as a “non-Newtonian” fluid, their movement and circulation in a bearing is dependent on the grease consistency, temperature, and force applied by nearby moving components, among other factors.

Introduction

(continued)

Published studies demonstrate that greases in wind turbine bearings do indeed move and circulate, but only in an area very close to the moving parts of the bearing. Therefore it is critical that any sampling methods provide effective means to obtain grease close to these moving zones or otherwise ensure that grease samples are not compromised by contaminating or diluting influences as they travel away from these flow zones. The methods outlined in this recommended practice provide several approaches to achieve this goal.

Wind Turbine Generator Bearing Grease Sampling Procedures

1. Method 1: Sampling from Bearing Drain Opening with Chute or Deflector

NOTE: In this section, “grease sampler” refers to the “passive grease sampling device” described in ASTM D 7718, Section 8. The “T-handle” describes a tool used to reach the grease sampler into the drain chute or bearing exit slot. This method ensures that the sample obtained is taken from the grease which has most recently exited the bearing. This method references the style of drain chute, shown in Figure A, common to certain Nordex units, with similar chute designs in other units. (See Figure A)



Figure A

1.1. Remove the purge container, if so equipped, from the generator bearing grease exit chute, shown by the red arrow in Figure A, and place the container in a clean area.

1.2. Note the condition of the material in the container. If the grease is excessively runny, hard, discolored, or contains shiny or dark particulate, note this on the sampling label.

1.3. Determine if there is sufficient clearance for a T-handle tool or similar sampling tool to insert the tool with a grease sampler into the drain chute. If not, the chute must be removed to obtain the sample.

1.4. If necessary, remove the grease sampler from packaging used to keep it clean until ready for use. Ensure that the open end of the grease sampler is clear of any cap and that the internal piston is positioned to close off the sampling tube.

1.5. Attach the grease sampler piston handle to the T-handle tool by inserting the end of the handle into the internal rod. (See *Figure B*)



Figure B

1.6. Insert the internal rod into the pusher tube, with the grease sampler facing forward. (See *Figure C*)



Figure C

1.7. Thread the base of the grease sampler into the female threads in the pusher tube and make adjustments to set the depth at which the sample will be taken. Position the T-Handle so that the extended position of the open end of the grease sampler will be inside the bearing housing, adjacent to the area of travel of the bearing within the housing. This is often a few inches longer than the position that would be flush with the surface of the generator housing.



Figure D

1.8. Position the pusher tube so that the internal piston is flush with the end of the grease sampler. By looking up into the chute or bearing drain, verify that there is sufficient accumulation of grease that it presents a solid area of grease for coring. If there is not sufficient grease to permit the coring process described here, go to Method 2 to obtain this sample.

1.9. Insert the grease sampler and T-handle into the chute or bearing drain until the positioning guides of the T-handle contact the outside edge, the chute, or drain hole in the generator housing.

1.10. Slide the pusher tube forward, while holding the T-handle firmly against the purge container lip, to core a grease sample close to the lower entry hole.

1.11. When the pusher rod has been slid completely forward, hold it in that position as the T-handle and grease sampler are withdrawn from the container.

1.12. Using a clean rag, wipe the excess grease from the T-handle parts and the OUTSIDE of the grease sampler body, being careful not to contact the grease inside.

1.13. Release the internal rod so that it spins freely and un-thread the grease sampler from the pusher tube.

1.14. If there is insufficient grease to sample using the T-handle, refer to Method 2 to manually extract grease from the lower entry hole area.

1.15. The open end of the grease sampler should be secured by placing a cap over the end prior to shipment. It may be necessary to purge a small portion of the grease from the sampler into the cap to avoid an air pocket being pushed into the sampler, displacing some of the sample through the far end of the sampler.

1.16. Once a small portion of the grease is in the cap, slide the cap on the grease sampler just far enough to engage the end of the sampler as a friction fit.

1.17. Place the filled and capped grease sampler into a suitable shipping tube to prevent leakage from the grease sampler and protect it during shipping.

1.18. Affix a sample label on the shipping tube, filling out all necessary information clearly and legibly, including equipment identification, sample date and time, sampler's name, and any notes or observations for the lab. Ensure all samples are clearly identified and promptly submitted to the lab for analysis.

2. Method 2: Sampling from Bearing Drain with a Spatula/Straw

NOTE: This method follows guidance provided in ASTM D7718, Section 10. This method assumes that the purge container opening is too small to allow the insertion of a grease sampler inside the container and the grease is to be manually extracted using a disposable spatula.

2.1. Using a clean, lint-free rag, wipe the outside of the grease purge container and surrounding area of the pitch bearing to avoid any of this external contamination from getting into the grease sample to be taken.

2.2. Remove the purge container, if so equipped, from the generator bearing grease exit chute, as shown by the red arrow in Figure A, and place the container in a clean area.

2.3. Inspect the exit chute or drain opening in the bearing to determine if there is sufficient grease accessible in this area for the required sample size.

2.4. Using a clean spatula or straw, remove grease from the inside of the drain area up to a point within about 1" of the moving parts of the bearing, if possible. In this purging step, ensure that a sufficient amount of grease remains to obtain the required sample amount.

2.5. Utilize a new, clean spatula or straw to gather grease from that area directly adjacent to the moving bearing parts and pack into an opened syringe. The syringe is opened by removing the plunger. In place of a syringe, a similar suitably clean, closeable container can be used to gather the sample. If the analysis to be performed is a small-volume method as outlined in RP-814, it may be necessary to use the syringe to inject grease into the "passive grease sampling device" described in ASTM D7718.



Figure E

2.6. Additional grease can be put into the grease sampler by reinserting the plunger in the syringe and pushing grease into the grease sampler to achieve maximum fill.

2.7. If there is insufficient grease in the drain path to fill the grease sampler, the remaining amount can be obtained from the chute at the end closest to the bearing or from the purge container. The grease closest to the opening is the most recently purged grease and the most representative of the current condition of the bearing. If a sample is obtained from these alternate areas, note this on the sample label so the analyst can take this into consideration.

2.8. The open end of the grease sampler should be secured by placing a cap over the end prior to shipment. It may be necessary to purge a small portion of the grease from the sampler into the cap to avoid an air pocket being pushed into the sampler, displacing some of the sample through the far end of the sampler.

2.9. Once a small portion of the grease is in the cap, slide the cap on the grease sampler just far enough to engage the end of the sampler as a friction fit.

2.10. Place the filled and capped grease sampler into a suitable shipping tube to prevent leakage from the grease sampler and protect it during shipping.

2.11. Affix a sample label on the sample container, filling out all necessary information clearly and legibly, including equipment identification, sample date and time, sampler's name, and any notes or observations for the lab.

2.12. Place the sampling container inside the shipping envelope or box and promptly send to the lab for analysis.

Summary

Proper grease sampling methods are crucial for comparing samples from one turbine to another or for trending samples from the same turbine. If the proper methods are not employed, grease samples can be obtained that do not represent the condition of the bearing wear, contamination levels, or the physical properties of the grease actively involved in lubricating the bearing. Any analysis from such inadequate samples will be misleading and result in improper maintenance actions being taken. Properly obtained samples ensure that analysis results represent current bearing conditions and provide the basis for sound maintenance decisions to provide reliable generator operation.